

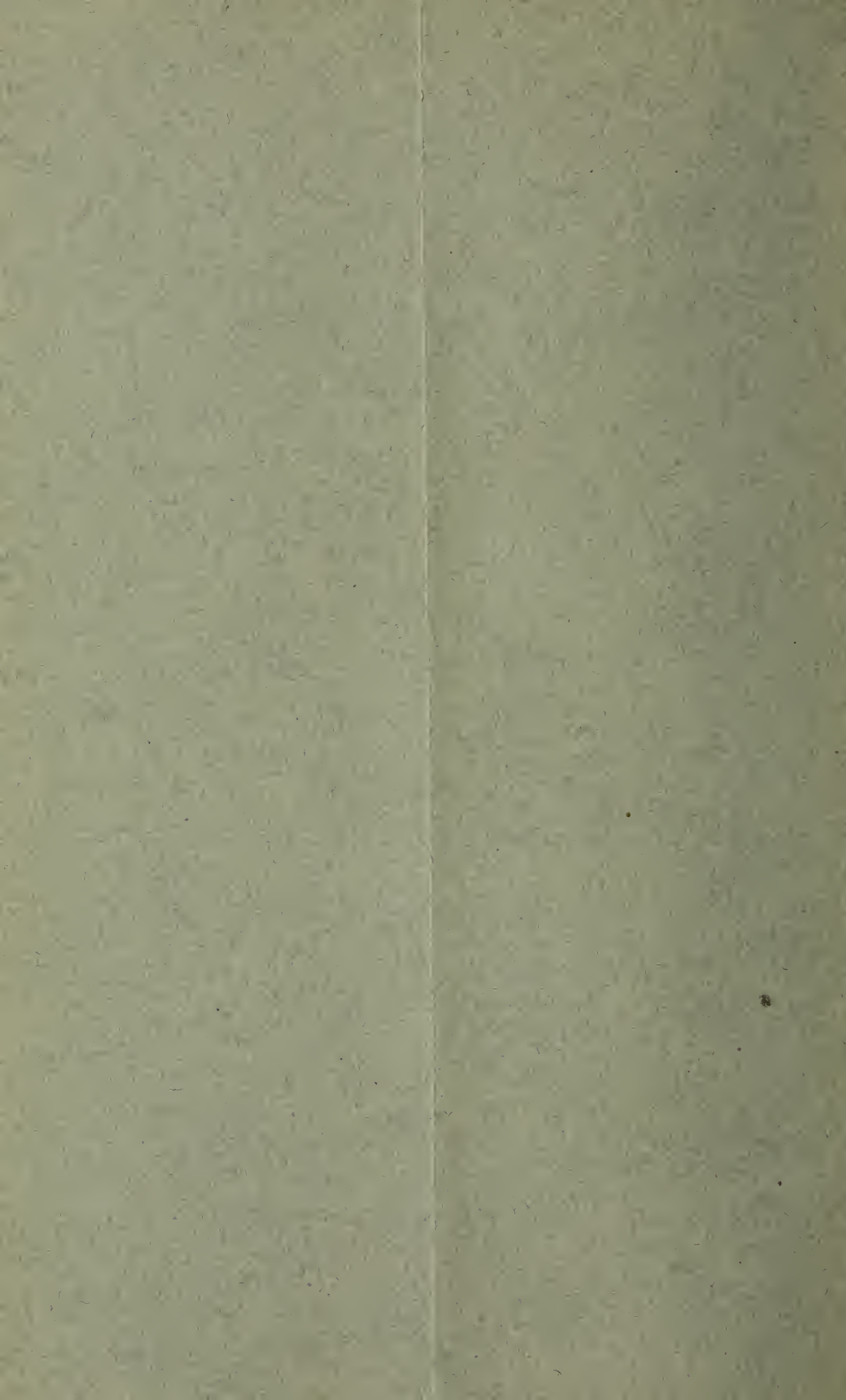
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THE
SCHOOL OF MINES
OF THE
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CATALOGUE,
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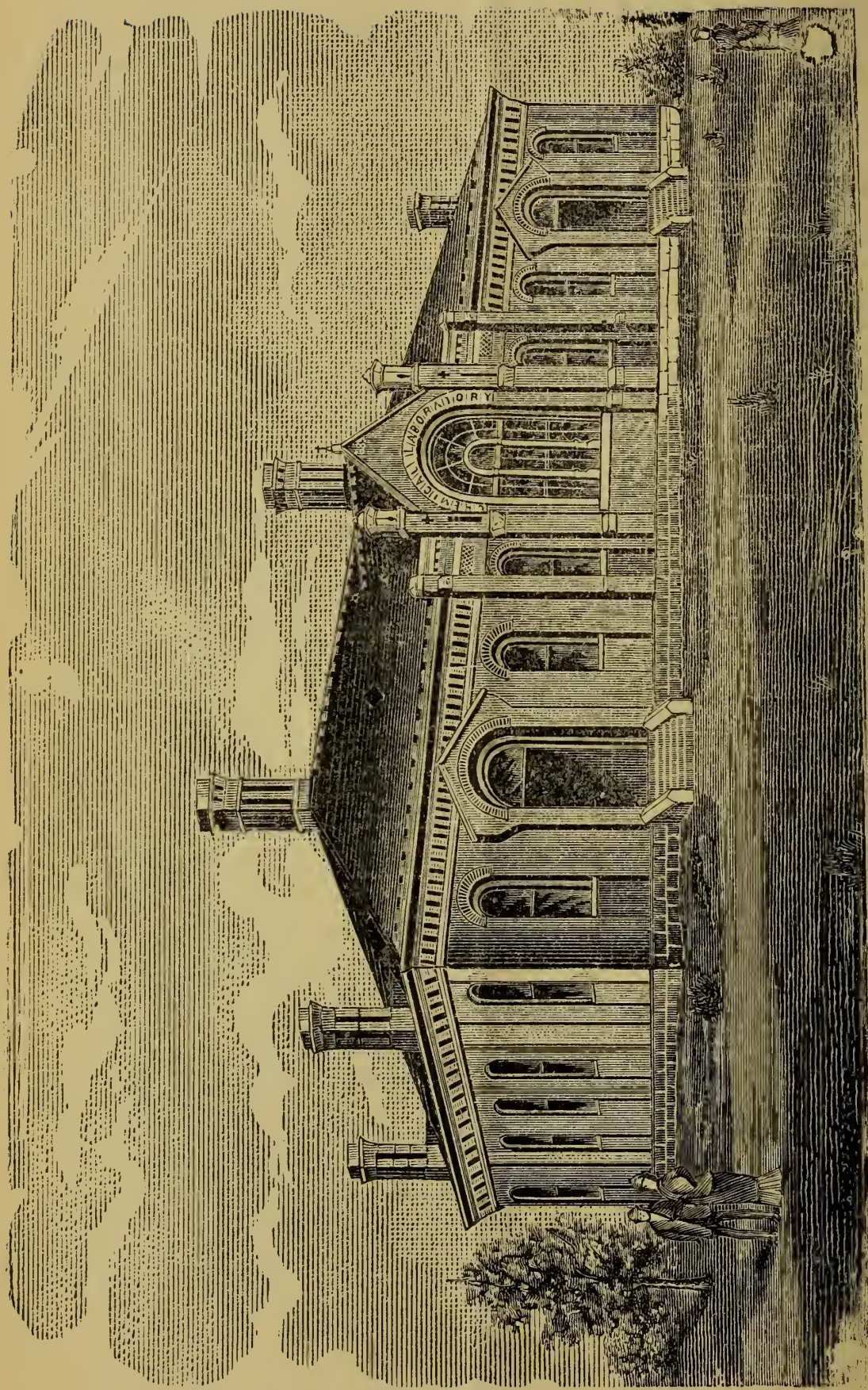




COLLEGE BUILDING.

“Work is Victory.”

Emerson.



LABORATORY.

THE
SCHOOL OF MINES
OF THE
UNIVERSITY OF MISSOURI.

CATALOGUE,
1888-89.

ROLLA, MO. :
ROLLA HERALD PRINT.

CORPORATION OF THE UNIVERSITY OF MISSOURI.

"The University is hereby incorporated and created a body politic, and shall be known by the name of THE CURATORS OF THE UNIVERSITY OF THE STATE OF MISSOURI."—Corporate name, Rev. Stat. 1879, Sec. 7230.

WILLIAM S. PRATT, A. M.,	-	-	-	-	Columbia.
JERRE C. CRAVENS, ESQ.,	-	-	-	-	Springfield.
DEWITT CLINTON ALLEN, ESQ.,	-	-	-	-	Liberty.

Term expires Jan. 1, 1889.

W. POPE YEAMAN, D. D.,	-	-	-	-	Columbia.
JAMES R. ESTILL,	-	-	-	-	Howard Co.
JOSEPH CAMPBELL,	-	-	-	-	Rolla.

Term expires Jan. 1, 1891.

J. S. MOSS, ESQ.,	-	-	-	-	Columbia.
CHARLES C. BLAND, ESQ.,	-	-	-	-	Rolla.
NORMAN J. COLMAN, U. S. Com. Ag.,	-	-	-	-	St. Louis.

Term expires Jan. 1, 1893.

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FACULTY.

W. H. ECHOLS, B. Sc., C. E., (University of Virginia),

Professor of Civil and Mining Engineering.

W. H. SEAMON, B. A. S., (University of Virginia),

Professor of Analytical Chemistry and Metallurgy.

W. B. RICHARDS, M. A., (University of Virginia),

Professor of Mathematics.

E. A. DRAKE, A. M., (University of Wisconsin),

Instructor in English.

P. J. WILKINS, B. S., (Michigan A. and M. College),

Assistant in Academic Department.

GEO. R. DEAN, (Missouri School of Mines),

Instructor in Mathematics and Physics.

INTRODUCTORY STATEMENT.

The School of Mines and Metallurgy is an Institute of Technology, a College of Engineering with Civil and Mining Engineering and Metallurgy as specialties. It is a College of the University of the State of Missouri, and is located at Rolla, Phelps County, on the line of the St. Louis and San Francisco Railway, about one hundred miles southwest of St. Louis. The location, pre-eminently healthful, is in the midst of an extensive and rapidly developing iron section with districts abounding in lead and zinc deposits within easy access, and thus affords excellent opportunities for the field study of the modes of occurrence of the ores of these metals as well as for the practical investigation of their methods of treatment.

The institution was opened in 1871 for the instruction of young men in the various branches of Civil and Mining Engineering and Metallurgy, with power to confer the degrees of Civil and of Mining Engineer. The School of Mines was organized under the provisions and on the conditions of an Act of Congress, approved July 2, 1862, granting government lands for the establishment of Schools of Agriculture and of Mechanical Arts. The School of Agriculture was located at Columbia in connection with the Academic Departments of the State University, while the School of Mechanical Arts was located as an Institute of Technology, under the name of the Missouri School of Mines and Metallurgy, at Rolla. The

first class was graduated in June, 1874, having completed the full course. The Eighteenth year of the institution is now closing.

It is the design of the School to give, in its special lines of work, instruction that is as complete and as exhaustive as may be attained, at once practical and thorough, based on the scientific principles of engineering. Its diplomas are granted only to those who win them by honest, earnest and successful work. Throughout the course, thoroughness and a high standard of excellence is constantly held in view, and no effort is neglected which may tend to secure to the student a training which may enable him to become a successful engineer and to reach a place among the educated engineers of the present day.

In order to maintain the high standard of the institution, it was found necessary to establish a preparatory department in which young men inadequately prepared could be trained to meet the requirements of the advanced professional work. This course is still maintained for the benefit of those who may wish to prepare themselves here for the work in the Technical Department.

At the session of 1886-87 of the Legislature of Missouri a bill was passed providing for the establishment of an academic course of study at the School of Mines. In pursuance of the provisions of this act the Academic Department was therefore organized, and it is hoped that the scope of its work may soon be extended beyond its present limits. Eventually it is but natural that the character of the work done in this department should partake of the scientific nature of the institution. The introduction of the modern languages (French and German), with extensive courses in the pure mathematics, Natural Philosophy and Geology, leading to the degree of Bachelor of Science, could but strengthen the College and make it a power for good. In the Academic Department, as at

present organized, a diploma is given upon successful completion of the work as laid out in that department.

By an act of the Legislature, in 1872, the doors of the University of Missouri were thrown open to women, and they now have access to all of its departments. A number of young women take advantage of this opportunity to attend the courses of study in the Academic Department of the School of Mines. They enter on an equal footing with the men and the same class of work is required of them.

ACADEMIC DEPARTMENT.

PROFESSOR DRAKE, AND PROFESSOR WILKINS.

The following Academic Course of study was established in pursuance of an act of the Legislature of Missouri, 1886-7. It is designed to make the course equal in every respect to those offered at the best academies. As now arranged it will commend itself especially to young men who wish to fit themselves for successful business or professional life, and to teachers who wish to prepare for the higher work in their calling.

ACADEMIC COURSE.

FIRST YEAR.

First Term.

Mathematics,	-	-	-	-	Arithmetic and Algebra.
Language,	-	-	-	-	English Grammar.
History,	-	-	-	-	U. S. History.

Second Term.

Mathematics,	-	-	-	-	-	-	-	Algebra.
Language,	-	-	-	-	Composition and Rhetoric.			
Science,	-	-	Physical Geography and Physiology.					

SECOND YEAR.

First Term.

Mathematics,	-	-	-	-	-	-	Geometry.
Language,	-	-	-	-	-	Latin, or German.	
Science,	-	-	-	-	-	-	Physics.

Second Term.

Mathematics,	-	-	-	-	-	-	-	Geometry.
Language,	-	-	-	-	-	-	-	Latin, or German.
History,	-	-	-	-	-	-	-	General History.
Science,	-	-	-	-	-	-	-	Civil Government.

THIRD YEAR.

First Term.

Language,	-	-	-	-	-	-	-	Latin, or German.
Literature,	-	-	-	-	-	-	-	English Literature.
History,	-	-	-	-	-	-	-	English History.

Second Term.

Language,	-	-	-	-	-	-	-	Latin, or German.
Science,	-	-	-	-	-	-	-	Chemistry, Botany, Political Economy, Book-keeping (optional).

LANGUAGE, LITERATURE AND HISTORY.

GERMAN.—The course extends through two years, and consists of exercises in translation and conversation, and of a study of the gems of German literature. An effort is made, first of all, to give the student a thoroughly practical knowledge of the language. In addition to this, technical students may acquire such facility in translation as will enable them to read German scientific works in the original. The excellent mental discipline that may be derived from the study of a foreign language, and the great aid that such study may afford to the understanding of one's own language, is not overlooked.

LATIN.—The course comprises Dr. Smith's *Principia Latina*, three books of Cæsar's Commentaries, and three

THE
Missouri School of Mines

Now offers to students two general classes of scientific work.
viz: professional, and academic. In each class there are three courses, each of which leads to the degree of Bachelor of Science.

PROFESSIONAL DEPARTMENT.

1. Bachelor of Science in Civil Engineering. This is the regular course in Civil Engineering as exhibited in the catalogue.

2. Bachelor of Science in Mining Engineering. This course is the same as that for Mining Engineers, omitting Engineering Mechanics, Mechanics of Machines, Theory of Prime Movers, and certain portions of advanced mathematics.

3. Bachelor of Science in Mechanical Engineering. This course will be introduced in the session of 1890-91. It will include the work of the Junior class in Engineering unchanged. The Intermediate class will study Physics and Elementary Mechanics in addition to the ordinary surveying. The Senior class will take a thorough course in Statics, Dynamics, The Mechanics of Machines, Theory of Prime Movers as operated by steam and electricity. The course in Chemistry is identical with that required of the Civil Engineers.

The work of each of these courses covers a period of three years. After graduation, when the student has become identified with his profession and has served efficiently therein a specified time, the full degree of Civil, Mining, or Mechanical Engineer will be conferred.

ACADEMIC DEPARTMENT.

In this department there are three courses of scientific work leading to the degree of Bachelor of Science. Before the applicant will be allowed to enter upon the work of any course he must have acquired a good knowledge of the English language, of elementary Geometry, and must have had as much Algebra as is required in the Preparatory Department.

The work in each course covers about three years, and is as follows :

1. Bachelor of Science (General Course). This course includes selected courses in Mathematics, Astronomy, Physics, Chemistry, Mineralogy, Geology, and Botany.

2. Bachelor of Science in Mathematics and Physics. Herein are included special and thorough courses in pure Mathematics, Dynamics, and Statics, and a selected course in Astronomy.

3. Bachelor of Science in Chemistry. This course includes comprehensive work in Chemistry for three years.—General and Industrial Chemistry, Mineralogy, Assaying, Qualitative and Quantitative Analysis, with work in the direction of original research.

In each of the courses the student is required to acquire either French or German to such a degree of efficiency as to be able to read at sight scientific works in that language. Spanish has been made an elective study to meet the needs of students who expect to go to parts of the country in which that language is spoken.

The last General Assembly appropriated five thousand dollars to the School of Mines for a club house. The building, to be completed next March, will contain commodious and comfortable rooms for thirty young men. The dining hall and culinary department will accommodate twice that number. The students in the building will form themselves into a club, and employ their own caterer. In this manner it is believed they will be able to board themselves at comparatively low cost.

The Missouri School of Mines now offers advantages which it has not been able to offer before in way of accommodation and thoroughly organized system of scientific work. The increase in the number and grade of its students the past two years is evidence of a higher appreciation of its work, in both Missouri and neighboring States. Every effort is being put forth by all connected with the institution to make it fulfil the purpose of its establishment, i. e., to furnish thorough instruction in Mechanical, Mining, and Civil Engineering, and to fit young men of Missouri for the industrial pursuits.

ROLLA, Mo., December 24, 1889.

books of Virgil's *Æneid*. The design is to give the student a thorough knowledge of the paradigms, the main principles of Latin construction, and as much facility in translation as may be needed for practical and professional purposes. The Allen and Greenough series of text-books is used.

ENGLISH GRAMMAR.—A familiarity with forms and with principles of construction is insisted upon. Written exercises are required daily, from the belief that painstaking practice under proper supervision is the best, if not the only, means of acquiring facility in the use of good English.

TEXT-BOOK.—Harvey's Grammar.

COMPOSITION AND RHETORIC.—It will be seen that this subject follows immediately, as it naturally should, upon that of Grammar. The student is required to practice letter writing at the very beginning of the work. From this style of composition to others, the steps are taken with ease. Instruction is given with a view to practical results: it is designed not only to impart a knowledge of principles but also to develop a facility in the application of them.

TEXT-BOOK.—Hill's Elements of Rhetoric and Composition.

ENGLISH LITERATURE.—An attempt is made to lead the student to form a correct estimate of the literary value of English productions, and also to direct his attention to the peculiar social and political conditions of which the literature of any particular period is an expression. In this regard, this course and that in English history are made to supplement each other. Time is given to a study of the master pieces from Chaucer's time to the present, and to a perusal of standard authorities on

the literature of the language. The library is well supplied with works of reference.

TEXT-BOOK.—Shaw's History of English and American Literature.

ENGLISH HISTORY.—It will be seen that this subject and that of English Literature are pursued during the same term. The two are so intimately associated that the importance of this arrangement can hardly be overestimated. An effort is made to present the subject of English History "in a manner that shall illustrate the great law of national growth, in the light thrown upon it by the foremost English historians." The library contains the works of many of the leading authorities on this subject.

TEXT-BOOK.—Montgomery's "The Leading Facts of English History."

GENERAL HISTORY.—It is designed to give the student a knowledge of the outlines of the world's history that may serve as a good foundation for further historical and literary work.

AMERICAN HISTORY.—An attempt is made to impart a knowledge of the causes and effects of the important events of history rather than to fill the mind of the student with an undigested mass of detail. Especial attention is given to the history of our country under the constitution. The drawing of historical maps, recitations from topics assigned, and frequent written reviews, are important features of the work.

TEXT-BOOK.—Barnes's Brief History of the United States.

CIVIL GOVERNMENT.—The text-book now in use (Young's Class-Book) gives an analysis of the Constitution of the United States, presents a comparative view of

the different state governments, treats of county and township organization, and affords an acquaintance with such principles of law as are involved in ordinary business transactions.

POLITICAL ECONOMY.—Practical exercises constitute an important feature of the text-book used. No attempt is made to inculcate any particular economic doctrine, but it is sought to give the student such an understanding of the principles of the science that he may apply them intelligently to the solution of such questions as may come under his consideration.

TEXT-BOOK.—Chapin's First Principles of Political Economy.

MATHEMATICS.

PROF. RICHARDS, PROF. WILKINS, AND MR. DEAN.

The Academic Course in Mathematics begins with Higher Arithmetic and is continued through Algebra and Geometry. To Arithmetic one term is devoted, to each of the last two. Students who can produce satisfactory evidence of a sufficient knowledge of Arithmetic will not be required to pursue that study. The object of the course is to give the student a comprehension of the principles involved in the elementary branches and a thorough acquaintance with their immediate application. At the same time that the facts are taught, the utility of mathematical study as a mental discipline is duly recognized, and an effort is made to promote habits of exact, logical reasoning and to stimulate originality and independence of thought. The solution of original problems, so valua-

ble both as an exercise and a test of acquirement, is made a prominent feature of the course.

In Arithmetic the vital principle and not the mere mechanical rule is what is sought to be inculcated, and the working of examples is a means not an end. Incidentally short methods of multiplication and division are introduced and insisted upon. In Algebra, the course begins with the fundamental operations and extends through Quadratic Equations and the Progressions. The class in Geometry completes the usual course in old Geometry, Plane and Solid.

The work in this department required for the Academic diploma is that subsequently laid down. Those, however, who wish to pursue their studies further may do so by joining the desired class in the Technical Department. Each class meets daily (five times a week) for one hour. The text-books and scheme of work are as follows:

FIRST YEAR.

First Term.—Arithmetic, Barnes' National.

Algebra, Wells' Academic to Simple
Equations containing more than one
Unknown.

Second Term.—Algebra, Wells' Academic, completed.

SECOND YEAR.

First Term.—Geometry, Wells' Plane and Solid, first
four books.

Second Term.—Geometry, Wells' Plane and Solid, completed.

The preparation necessary for this course is a good knowledge of Arithmetic to Percentage: at the same time some acquaintance with Algebra will greatly facilitate progress.

SCIENCE.

BOTANY.—The course comprises the elements and principles of descriptive and systematic Botany, together with occasional lectures on the economic uses of various plants. The student is required to begin the analysis of plants as soon as they begin to bloom in the spring, and to continue analyzing till the end of the term. Frequent botanical excursions by the class are insisted on for the purpose of familiarizing the student with the haunts and habits of all the common plants of the vicinity.

TEXT-BOOK.—Gray's School and Field Book.

CHEMISTRY.—The design of this course is to acquaint the student with the most important facts and principles of the science without going into minor details. Instruction is given by lectures, illustrated by means of experiments, and by recitations based upon the subject matter contained in Norton's Elements of Chemistry, Revised Edition. The class meets five times each week throughout the second term.

PHYSIOLOGY.—It is aimed to make the instruction in this branch as practical as possible, and to lead the student to obey the injunction "Know thyself." Hints on Hygiene are given, also rules for action in cases of emergency.

TEXT-BOOK.—Steele's Hygienic Physiology.

PHYSICS.—In this course the object constantly held in view is to present simply and plainly the fundamental truths of Natural Philosophy; to define clearly the nature of force and of motion, and the laws which they obey; and to teach the student to apply these laws to the solution of such simple problems of statics and dynamics as relate to common and familiar phenomena. The subjects of sound, light, heat, and electricity are introduced upon

a scientific basis and are illustrated throughout the course by experiments. The department is supplied with apparatus of all kinds necessary for this purpose. For academic students the course extends through the first term of the second year.

PHYSICAL GEOGRAPHY.—In this branch attention is directed to the causes of natural phenomena. Meteorology and the signal service receive special attention.

TEXT-BOOK.—Guyot's Physical Geography.

BOOK-KEEPING.—This study is not required, but will be taught upon the application of at least five students for instruction therein. The course comprises principally Double Entry. Various kinds of business are represented, and all the modern conveniences and auxiliaries are explained and used. The student is required to finish at least six different sets of books. Those who complete these before the end of the term will be furnished with abundant material for further practice.

TECHNICAL DEPARTMENT.

The work of this Department is distributed among the five Schools of Civil and Mining Engineering, Analytical Chemistry and Metallurgy, Pure Mathematics, Mineralogy and Geology and Physics. At present instruction is given in Mineralogy and Geology by the Professor of Chemistry; while the elementary work of Physics is chiefly carried on in the Preparatory Department, the course in Analytical Mechanics is now assigned to the School of Engineering.

To enter the Department it is essential that a thorough knowledge of the elements of Algebra, Geometry, Physics and Chemistry be acquired. The Preparatory Department enables those who are insufficiently prepared in these subjects to review them here.

The Technical Department offers two distinct courses of study, each extending through three years and leading to the degree of Civil Engineer and of Mining Engineer respectively. Applicants for these degrees are in all cases required to complete the full amount of work here, as is laid out, in order to secure the degree. While the work of each course is distributed among three distinct classes, each class extending through one year, the degree is not conferred for attendance during any definite or indefinite period of time, but for actual work done. Thus young men who are well prepared and capable may by diligence secure the degree in two years.

Besides the regular degree courses students may take special courses in Engineering, Chemistry, Assaying or Mathematics, and will be given certificates for the amount and quality of work performed.

COURSE OF STUDY FOR CIVIL ENGINEERS.

JUNIOR CLASS.

Trigonometry,	Descriptive Geometry,
Analytic Geometry,	Engineering Instruments,
General Chemistry,	Drawing,
Blowpipe Analysis,	Field Work.
Qualitative Analysis,	

INTERMEDIATE CLASS.

Solid Analytic Geometry,	Geodesy,
Differential Calculus,	Engineering Constructions,
Integral Calculus,	Lines of Communication,
Chemical Technology,	Drawing,
Mineralogy and Geology,	Field Work.

SENIOR CLASS.

Analytical Statics,	Stability of Structures,
Applied Mechanics,	Hydraulic Engineering,
Assaying,	Field Work,
Drawing,	Thesis.

COURSE OF STUDY FOR MINING ENGINEERS.

JUNIOR CLASS.

Trigonometry,	Descriptive Geometry,
Analytic Geometry,	Engineering Instruments,
General Chemistry,	Drawing,
Blowpipe Analysis,	Field Work.
Qualitative Analysis,	

INTERMEDIATE CLASS.

Solid Analytic Geometry,	Geodesy,
Differential Calculus,	Exploitation of Mines,
Integral Calculus,	Drawing,
Chemical Technology,	Field Work,
Mineralogy and Geology,	Assaying.
Qual. and Quan. Analysis,	

SENIOR CLASS.

Metallurgy,	Dynamics,
Qualitative Analysis,	Mechanics of Machines,
Quantitative Analysis,	Theory of Prime Movers,
Assaying,	Thesis.

SCHOOL OF ENGINEERING.

PROF. W. H. ECHOLS.

The School is organized with a view to acquaint the student *familiarly and practically* with the principles of his profession. The instruction is as thorough as possible, and is given partly through text-books and partly through lectures, with daily examinations upon both. A high standard of excellence in attainments is rigidly adhered to and required for the satisfactory completion of the course.

The work of this department is distributed among three classes, as follows:

JUNIOR.

1. *Descriptive Geometry*.—Theory of Parallel Projections, Orthogonal, Axonometric and Oblique, with the Construction of Shades and Shadows. Theory of Central Projections, or Linear Perspective.

2. *The Instruments*.—The instruments of the engineer, both field and office, are considered in order—their principles, details, construction, adjustments and uses.

3. *Drawing*.—The easy and accurate use of pen and brush is first acquired by exercises, and developed by application to projective drawings, shading and shadows; lettering.

4. *Field Work*.—The members of the Junior Class enter the corps with the grade of Rodmen, and are required to do duty in that capacity before being advanced.

INTERMEDIATE.

1. *Engineering Geodesy*.—Theory and descriptions of the engineering field instruments, their uses, capabilities,

measures of approximation and of precision are thoroughly discussed and applied in the measurement of horizontal and vertical distances and angles; general and particular methods and problems in traversing; triangulation, direct and indirect levelling; land, city, orographic and hydrographic surveying; government and engineering geodetic work; tachymetric processes.

2. *Engineering Construction*.—Surface excavation and mensuration of same; construction of shafts and tunnels; foundations on land and under water; materials of construction—timber, stone, brick, mortars and cements, and iron; building construction.

3. *Lines of Communication**.—Preliminary survey, location and construction of railways, highways, streets, canals, tunnels and bridges.

4. *Exploitation of Mines*†.—Ore deposits in beds, lodes, placers and pockets; location and attack by shaft, incline and adit; underground transport in galleries, inclines and shafts; drainage by adits or pumps; ventilation by furnace or blowers; lighting; and mechanical concentration of ores.

5. *Drawing*.—The applications of projective geometry to stone cutting; the projections, templates and directing instruments for same; and to spherical projections; the representations of underground workings of mines in plan, elevation and axonometric projections; working draughts of engineering structures, such as piers, foundations, wing walls, abutments, coffer-dams, caissons, trestles, mine timbering, etc., in all their details; construction of maps.

6. *Field Work*.—The members of the Intermediate Class rank in the corps as instrument men, and in the field acquire practical knowledge of the use of all the field instruments of the engineer, including the compass, barometer, level, transit, solar, stadia and plane table.

SENIOR.

1. *Engineering Mechanics*.—General theory of force, stress, strain, energy, and hydraulics, with applications to the analysis of structures; to the design of the elements of structures and machines; to thermodynamics and the theory of heat engines; to the design of flywheels, governors, etc.; pipes for water, air and steam; ditches, flumes and canals for water, etc.

2. *Stability of Structures**.—Amount and distribution of load on structures; stability of elementary structures, the girder, the cable, the arch, the pier, with applications to the design of bridges, roofs, buildings, dams, abutments, arches, revetments, etc.

3. *Hydraulic Engineering**.—Collection and filtration of potable water; conveyance of water, either by gravity or pumping; drainage, sewerage and water supply of cities and towns; disposal of sewage.

4. *Mechanics of Machines*†.—Theory of gearing, simple and compound; constructive mechanism, including the design of machines; efficiency of mechanism; regulators, including brakes; accumulators, governors and valves; transmission of energy and power, teledynamic, pneumatic and electric.

5. *Theory of Prime Movers*†.—Hydraulic engines, water wheels, turbines and pumps; steam engines, including the design of the furnace, the boiler, the condenser and the engine proper; pneumatic engines and blowers; electric engines and dynamos.

6. *Drawing*.—The application of graphical analysis to the solution of statical problems of design, the strains in structures; lines of resistances in dams, arches and piers; finished drawings, with colors and shadows in connection with the structures designed, their details in full; topographical maps.

7. *Field Work*.—The members of the Senior Class enter the field as chiefs of parties, and it is under their direction and charge (subject to the professor's instruction) that the corps carries on the prescribed field work and surveys.

Subjects marked with * are not required for the degree of M. E., those marked with † are not required for the degree of C. E.

A course of parallel reading of monographs by the best authors (with which the library is abundantly supplied) is prescribed in connection with the lectures and the subject matter included in the examination papers. The best engineering periodicals of America, England and France are taken by the department and are always at the disposal of the student, who is constantly referred to them and urged to read them. In the field work the student is thoroughly drilled in the best methods of survey and location known in modern practice. Expert and rapid manipulation of all the field instruments of the engineer is insisted upon: accuracy combined with rapidity is the essential feature. In the drawing room the student is steadily employed throughout the course, in every variety of pen work of which the engineer makes use. In projective geometry the course is extensive and thorough, and assiduous use of the drawing board is necessary for success. Especial attention is given to the Graphical Statics, and to the solution of engineering problems by aid of the graphical processes. In design, specifications are furnished the student and written theses required, showing the design accompanied by all the necessary computations (arithmetical and graphical), finished drawings of the structures and details of the pieces, with working draughts for workmen. Particular stress is laid upon railway engineering as practiced in this country in all its details of preliminary survey, location and construc-

tion. In all the work of the department the student is encouraged to think for himself, to acquire confidence in what he knows to be correct, and to depend upon his own resources, to grasp subjects and not text-books.

In the absence of a professor for the chair of Physics, instruction in Analytical Mechanics is given in the department. Todhunter's Analytical Statics, New Edition, and Williamson's Dynamics are gone through in the beginning of the Senior year, thus preparing the student to take firm hold of the Applied Mechanics of the Engineering School.

While the degree courses as laid down will be strictly adhered to for all who apply for the degrees, special students may pursue any particular course which they may elect and receive certificates therefor. Men who have neither the time nor the means to enable them to take the full engineering course will find it advantageous to concentrate a year's work upon some special branch of the profession.

Text-Books.—Johnson's Theory and Practice of Surveying; Church's Descriptive Geometry; Waldo's Manual of Descriptive Geometry; Warren's Shades and Shadows; Higher Perspective; DuBois' Graphical Statics. Rankine's Applied Mechanics, Civil Engineering, Machinery and Millwork, and Steam Engine; Cotterill's Applied Mechanics. Callon's Lectures on Mines; Smyth's Coal Mining; Field Book, Searles or Henck; Trautwine's Pocket Book.

SCHOOL OF ANALYTICAL CHEMISTRY AND METALLURGY.

PROF. W. H. SEAMON.

The courses in this School have been especially arranged for the benefit of applicants for the degrees of Civil and Mining Engineer. Students who are desirous and capable of accomplishing special lines of work, may arrange for such courses in Analytical Chemistry and Assaying as are adapted to their special requirements.

The following courses are regularly given each session :

1. General Chemistry.
2. Chemical Technology.
3. Metallurgy.
4. Analytical Chemistry.
5. Assaying.

1. GENERAL CHEMISTRY.—The instruction in this course is communicated to the members of the Junior Class by means of lectures and recitations based upon Watts' Edition of Fowne's Chemistry. The course comprises the subjects of Chemical Physics, Chemical Philosophy and Inorganic Chemistry, and in addition regular weekly exercises in Stoichiometry and other problems of a chemical nature. The class meets three times each week throughout the session.

2. CHEMICAL TECHNOLOGY.—This subject is only required of applicants for the M. E. degree. The Intermediate Class meets three times each week throughout the session. Instruction is communicated by lectures and recitations. The general principles involved in the smelting and working of the metals are first studied, followed

by a description and explanation of the processes employed in the manufacture of Acids, Salts, Glass, Paper, Mortar, Cements and other Building Materials, Sugar, Wines, Spirits, Oils, Paints, Soaps, Dyeing and Bleaching Materials, &c., &c. Special attention is given to the processes employed by American manufacturers.

While the school is at present but poorly supplied with the diagrams, models and specimens for thorough instruction, the additions which are being constantly made to its equipment will eventually make it approach to what it should be.

3. METALLURGY.—In addition to the brief course required of the Intermediate Class, the members of the Senior Class meet weekly for the discussion of assigned topics in the Metallurgy of Gold, Silver, Copper, Zinc, Lead and Iron. Special topics are assigned, upon which each student is required to prepare a paper embodying the results of his reading in the authoritative works on Metallurgy, with which the Library is well supplied; these papers are taken up in class and critically discussed by the other students.

Books of Reference.—Crooke's and Rohrig's, Percy's, Eggleston's and Phillipps' works on Metallurgy, and Bell's Iron Smelting, &c.

4. ANALYTICAL CHEMISTRY.—The work of this course extends throughout three years, being divided as follows:

Junior Class.—Required of all applicants for degrees. Blowpipe Analysis (Text-Book, Ernis'), Qualitative Analysis (Fresenius').

Intermediate Class.—Quantitative and Qualitative Analysis (Fresenius'), Assaying (Ricketts').

Senior Class.—Quantitative and Qualitative Analysis with original investigation.

The Junior Class meets regularly three times each week for instruction and practice. Previous to beginning practice with the Blowpipe, each student is required to complete a series of selected exercises designed for preliminary training in chemical manipulation and to illustrate the properties of the more important chemical elements and the nature of chemical reactions.

Salts, oxides and alloys are given to each student, on whose composition, as determined by Blowpipe tests, he is required to report. Three months is required to complete the practice, after which exercises in Qualitative Analysis are given. These exercises, at first simple, are made more and more complex as the skill of the student increases. While the daily work of each student is closely observed and his errors corrected, he is interfered with only when deemed absolutely necessary; by this method he gradually acquires the self-reliance so essential for success in chemical pursuits.

The work of the Intermediate and Senior Classes consists principally of Quantitative Analysis, with work in Assaying and Qualitative Analysis. Each student is required to satisfactorily complete analyses of the following substances (or their equivalent):

(1) Zinc Sulphate; (2) Barium Chloride; (3) Alum; (4) Chrome Alum; (5) Sulphate of Iron and Ammonia; (6) Blue Vitriol; (7) Calcite; (8) Calamine; (9) Galena; (10) Chalcopyrite; (11) Orthoclase; (12) Kaolin; (13) Hematite; (14) Pyrolusite and Chlorine, valuation; (15) Soda Ash, valuation; (16) Bleaching Powder, valuation; (17) Cerussite; (18) Smithsonite; (19) Blende; (20) Coal, proximate; (21) Coal, ultimate and heating power; (22) Stibnite; (23) Realgar; (24) Blast Furnace Slag; (25) Lead Furnace Slag; (26) Pig Iron; (27) Bismuth Litharge; (28) Commercial lead; (29) Spelter; (30) Regulus; (31) Beryl; (32) Illmenite; (33) Chromite; (34) Saltpetre soil; (35)

Mineral Water; (36) Milk; (37) Superphosphates; (38) Guano.

Besides this series there is the usual practice in the fire assay of the ores of lead, silver and gold, and the docimastic valuation of the ores of the most common metals. Exercises in Determinative Mineralogy are regularly given.

Special students may pursue, at their discretion, the study and analysis of any class of ores or metallurgic products. Young men, who have neither the time nor means to spare to take the full course, may accomplish much in the way of chemical analysis by devoting their entire time to it during the course of a single year.

5. ASSAYING.—The course in assaying begins with the second term of the second class, usually about February 1. This work is usually completed in five months.

Special attention in this course is given to the rapid estimation and valuation of ores and furnace products, both by the fire and wet assay.

Fire Assays.—Gold and silver ores, also mill checks, are made the subjects of special study, and assays both by the crucible and scorification methods are required. Lead and copper ores are assayed by fire methods applicable to the ores in question.

Wet Assays.—Volumetric methods are carefully studied and applied to the rapid determination of copper, zinc, iron, etc., etc.

In the construction of the new laboratory, no pains were spared to make the assay laboratory complete in every respect. It is located on the first floor and not in the basement; it has an abundance of light and excellent ventilation.

The reduction as well as the cupelling furnaces are the newest and best, and have ample capacity. Other acces-

sories, such as ore crusher, pulverizing plate, water, gas, etc., are all provided to facilitate the work.

THE NEW CHEMICAL LABORATORY.

The new Chemical Laboratory has been in use three years, and has been found satisfactory in every respect. It was planned and built solely with reference to the work in the school, and the entire building is used by the Chemical Department.

In this building there are the following departments: The quantitative laboratory; the qualitative laboratory; director's laboratory; lecture room; assay laboratory and weighing room; a quantitative and qualitative evaporating room; preparation room; a supply room, and two basement rooms, furnishing accommodations for seventy-five students.

Facilities for securing heat, light and ventilation are very perfect, ample provision is also made for carrying off foul and dangerous gases. All parts of the building are thoroughly and judiciously equipped; nothing has been left undone to make this laboratory one of the most complete in the country. Gas and water are supplied to each table.

The laboratory contains, in addition to a large assortment of the apparatus regularly and ordinarily met with in well equipped institutions, one of Becker's Lithological Microscopes, Contact and Reflecting Goniometers, Dynamo for experimental work in Electrolysis, and other valuable pieces of apparatus for work and research.

The Chemical Laboratory is open to students for work, daily, from 8 A. M. to 5 P. M.

SCHOOL OF MINERALOGY AND GEOLOGY.

The instruction on these subjects is communicated to the members of the Intermediate Classes in Civil and Mining Engineering.

Models, diagrams and natural crystals are used in imparting a knowledge of the principles of Crystallography. Systematic Mineralogy is taught in conjunction with exercises in Determinative Mineralogy.

In addition to the usual course in Physical Geography, Dynamical, Structural and Historical Geology, special attention is given to Chemical and Economic Geology. The course of instruction embraces the origin of vein stones and ore deposits, mineral waters, coal, petroleum and natural gas.

SCHOOL OF MATHEMATICS.

PROF. RICHARDS.

The course in Pure Mathematics for the Engineer's degree extends through the Junior and Intermediate years. The preparation necessary to pursue successfully the studies of the school in this Department is a thorough knowledge of elementary Algebra and Geometry. Starting from this point, the course is designed to give the student as comprehensive an acquaintance with the branches of the Higher Mathematics usually included in college curricula as is consistent with thoroughness, em-

phasizing, as occasion suggests, those points which have an especial bearing upon the technical work for which the course is a preparation. While the work of the school thus, naturally, takes color from the technical character of the institution, the independent worth of the Pure Mathematics is not sacrificed, and the course will, it is hoped, be found sufficiently full to attract those who desire to know Mathematics for its own sake.

The Junior Class meets five times a week, the Intermediate, thrice. At each meeting, the class is examined on matter previously assigned, and, when expedient, explanations of the text and supplementary lectures and notes are given. The student is constantly exercised in work at the black-board, reproducing demonstrations and applying demonstrated principles to the solution of special examples.

JUNIOR CLASS.

The Junior Class studies Trigonometry, Plane and Spherical, throughout the first half of the year. The class is thoroughly drilled in the Fundamental Definitions and Formulæ. The construction and use of Logarithmic tables are taught, and numerous examples in the solution of triangles, involving the use of Logarithms, are given. Occasionally actual heights and distances are required to be calculated by Trigonometric methods.

The second half of the year is taken up with the study of the Conic Sections and a few of the Higher Plane Curves.

Text-Books. — Snowball's Trigonometry (Plane and Spherical), Bowser's Analytic Geometry (with supplementary notes). *For Reference.*—Todhunter's Plane and Spherical Trigonometry, Puckle's Conic Sections, Todhunter's Conic Sections, Searle's or Henck's Field Book, Christie's Math. Ex. Questions.

INTERMEDIATE CLASS.

The class begins with Analytic Geometry of Three Dimensions, studying only surfaces of the second degree—the conicoids. The Differential Calculus is then taken up, and the principles arrived at are applied in the development of functions, the solution of problems of maxima and minima, the investigation of the properties of curves, and the tracing of curves from their equations. In the Integral Calculus, the elementary formulæ of integration are developed and applied to numerous examples, and considerable attention is paid to the use of Definite Integration in the rectification of curves, the quadrature of surfaces and the cubature of volumes.

Text-Books.—Venable's Notes on Solid Geometry, Williamson's Differential Calculus, Williamson's Integral Calculus. *For Reference.*—Todhunter's and Salmon's Mathematical works and the Mathematical articles in the Encyclopædia Britannica.

The brevity of the course precludes any extended study of the History of Mathematics, but the main facts in the history of each subject are outlined at some appropriate time during its consideration.

For students who desire to pursue a wider course of reading than that here laid down, classes will be formed upon application. This work will be varied to meet the needs and accord with the purposes of the applicants. A class next year will read a selected course in Modern Geometry, Theory of Equations, Theory of Determinants, and Differential Equations.

Text-Books.—Cremona's Projective Geometry, Todhunter's Theory of Equations, Muir's Theory of Determinants, Boole's or Forsyth's Differential Equations.

A collection of the chief English and French works on Mathematics, which is contained in the Library, affords

the student an opportunity of extending his research *ad libitum*.

PREPARATORY COURSE.

The following course of study is maintained for the benefit of those students who find it necessary to give themselves special preparation for the technical courses. The completion of this course admits the student to either of the technical courses without examination.

FIRST YEAR.

First Term.

Mathematics,	-	-	-	-	-	-	-	Higher Arithmetic and Algebra.
Language,	-	-	-	-	-	-	-	English Grammar.
History,	-	-	-	-	-	-	-	U. S. History.

Second Term.

Mathematics,	-	-	-	-	-	-	-	Algebra.
Language,	-	-	-	-	-	-	-	Composition and Rhetoric.
Science,	-	-	-	-	-	-	-	Physical Geography.

SECOND YEAR.

First Term.

Mathematics,	-	-	-	-	-	-	-	Higher Algebra, and Geometry (Plane).
Science,	-	-	-	-	-	-	-	Physics.

Second Term.

Mathematics,	-	-	-	-	-	-	-	Higher Algebra, and Geometry (Space).
Science,	-	-	-	-	-	-	-	Chemistry, and Physics.

CHEMISTRY.—This course is intended to prepare Technical students for Laboratory work, which begins in the second year. Norton's Elements of Chemistry, Revised Edition, is the text-book used. The class meets five times each week.

PHYSICS.—In this class, which meets five times each week throughout the year, the foundation is laid for the course in Mechanics of the Technical Department. The fundamental ideas and laws of force, motion, energy and work are dwelt upon at length, and great care is taken to convey to the student correct and sound notions on these important points. The subjects of sound, light, heat and electricity are then taken up, the laws which they obey given and explained simply and clearly. A prominent feature of the course is experimental illustration, for which purpose the equipment in apparatus is excellent.

MATHEMATICS.—A thorough knowledge of elementary Algebra and Geometry is absolutely essential to any successful prosecution of the higher branches of Mathematics, and this course is framed to give those who are insufficiently prepared in these subjects an opportunity to obtain the requisite acquaintance with them. The studies of the First Year and the text-books used are the same as those already laid down in the Academic Department, (p. 11). The special feature of the second year's work is an extended course in Algebra. This will include a hurried review of the elementary processes, a wider discussion of problems leading to equations with the interpretation of their results, Theory of Exponents, Surds, Imaginaries, the Progressions, Permutations and Combinations, Binomial Theorem, Series, Logarithms, Theory of Numbers, with an introduction to the Theory of Equations.

Text-Book.—Todhunter's Algebra for Schools and Colleges, with lectures.

At the same time, the class takes a thorough course in the old—Euclidian—Geometry, with numerous original exercises. Text-Book, Wells' Plane and Solid Geometry.

This is recognized as an important period in the student's work and every effort is made to have him acquire that firm basis without which his subsequent superstructure cannot be stable. His attention is called to the logical processes involved in the demonstrations, and an attempt is made to have him apply the same rigorous methods to his own thought. Principles learned are constantly illustrated and impressed by requiring their application to the solution of problems. Incidentally the student is acquainted with the noteworthy facts in the origin and development of the subject which he is studying.

GENERAL INFORMATION.

BUILDINGS AND EQUIPMENTS.

The buildings of the School of Mines are situated in the most elevated part of the city of Rolla. They are substantial brick structures, well ventilated and lighted, and heated by the best furnaces manufactured. The main building has recently been painted and calcimined throughout, and the laboratory, one of the most complete in the country, has been in use but three years.

The different departments of the School are well supplied with apparatus. Several hundred dollars have been expended this year in the purchase of instruments and apparatus for the Engineering and Chemical departments, and further purchases will be made as additional needs are felt and the financial condition of the School will allow.

LIBRARY.

The Library contains 2,100 volumes. There have recently been added about four hundred volumes on Engineering, Mathematics, Chemistry, and Metallurgy. The library is now supplied with the latest works on these subjects, and any student who may wish to pursue an extended course of reading in connection with his class work has here an ample opportunity. There are also the standard works in English and American poetry,

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fiction, biography, and history, provided with especial view to the needs of Academic students. About twenty Engineering, Mathematical, and Chemical Journals, domestic and foreign, are kept on file for the use of Faculty and students.

The library is open at regular hours, and all students of the institution may use the books, under certain regulations, free of charge.

EXAMINATIONS.

Final and intermediate examinations are held for the purpose of testing thoroughly the student's knowledge of the subject pursued. In addition to these, other examinations are given, during the progress of work upon any subject, at the discretion of the professor in charge.

DEGREES.

The degree of *Civil Engineer* is conferred upon such students as satisfactorily complete the Civil Engineering Course.

The degree of *Mining Engineer* is conferred upon such students as satisfactorily complete the Mining Engineering Course.

No degree is conferred for the completion of the Academic Course, but a diploma is granted certifying that the student is a graduate in the academic department.

COMMENCEMENT.

The annual Commencement exercises are held in the Assembly room, at the close of the work in June. The exercises consist of an address by some prominent speaker, the conferring of degrees and granting of diplo-

mas by the Director, and an essay or oration by some member of the graduating class.

Last year the address was delivered by Hon. J. W. Emerson, United States Marshal for the Eastern District of Missouri.

FEES, EXPENSES, ETC.

The fee for tuition is ten dollars per term. A bill is now pending before the State Legislature, however, designed to make tuition at the School of Mines free.

All laboratory students furnish their own blow-pipes, platinum, silver and gold solutions, crucibles, and apparatus, and pay for gas and fuel consumed and for apparatus damaged or destroyed. A deposit of five dollars per term, covering the value of the apparatus and chemicals issued, is required to be placed in the hands of the Treasurer by each laboratory student. This deposit, less the value of material consumed, is returned at the close of the year.

Good boarding, at places approved by the Faculty, can be obtained at from three dollars to four dollars per week.

The following is a careful estimate of necessary expenses for a college year :

Tuition, - - - - -	\$20.00.
Contingent expenses for laboratory, - -	\$20.00.
Board, fuel, washing, and lights, from \$96 to \$150.00.	
Books, stationery, &c., - - - - -	\$8 to \$20.00.

MONTHLY REPORTS.

Regular monthly reports are sent to the parent or guardian of each student showing the student's grade in scholarship for the month, and giving such other information in regard to his progress, attendance, etc., as may be thought to be of interest.

SCHEME OF LECTURES, TECHNICAL DEPARTMENT.

	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
9-10	Jr. Chemistry. Int. Eng.	Sr. Metallurgy. Int. Eng.	Jr. Chemistry. Int. Eng.	Sr. Metallurgy. Int. Eng.	Jr. Chemistry. Int. Eng.
10-11	Jr. Math. Int. Chem. Tech. Sr. Civil Eng.	Jr. Math. Min. and Geo. Sr. Mining Eng.	Jr. Math. Int. Chem. Tech. Sr. Civil Eng.	Jr. Math. Min. and Geo. Sr. Mining Eng.	Jr. Math. Int. Chem. Tech. Sr. Civil Eng.
11-12	Jr. Eng. Int. Math..	Jr. Eng. Int. Math.	Jr. Eng. Int. Math.	Jr. Eng. Int. Math.	Jr. Eng. Int. Math.
2-4	Laboratory.	Drawing. Field Work.	Laboratory.	Drawing. Field Work.	Laboratory.

TIME-TABLE FOR THE ACADEMIC AND PREPARATORY COURSES.

FIRST TERM.

9-10.	10-11.	11-12.	1-2.	2-3.	3-4.
Latin, (First year). German, (First year). Algebra, (Second year). Algebra, (First year).	English Literature. Arithmetic.	U. S. History. Physics.		Latin, (Second year) German, (Second year).	English History. English Grammar. Geometry.

SECOND TERM.

Latin, (First year). German, (First year). Algebra, (Second year). Algebra, (First year).	Civil Government, (Half hour). Political Economy. (Half hour). Physics.	General History. Physical Geography. (Half hour). Physiology, (Half hour). Chemistry.	Book-keeping.	Latin, (Second year). German, (Second year).	Rhetoric. Botany. Geometry.
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CALENDAR.

1889.

June 13, Thursday, 10 A. M. - Annual Commencement.

September 16, Monday, - - First Term begins.

September 16 and 17, - - - Entrance Examinations.

December 20, Friday, - - - Christmas Holidays begin.

1890.

January 7, Tuesday, 9 A. M. - Exercises resumed.

January 27, Monday, - - - Examinations begin.

February 1, Saturday, - - - Examinations close.

February 4, Tuesday, 9 A. M. - Second Term begins.

June 14, Thursday, 10 A. M. - Annual Commencement.

GRADUATES.

1874.

John W. Pack, M. E.—Assistant Assayer, U. S. Mint, San Francisco, Cal.

Gustavus H. Duncan, C. E.—Boulder, Colo.

*John H. Gill, C. E.—U. S. Engineering Dep't, Washington, D. C.

1875.

Almon W. Hare, M. E.—Chemist and Assayer, Aspen, Colorado.

Francis J. Deegan, C. E.—Engineer Louisville, New Orleans and Texas Railway.

1876.

John E. McGrath, C. E.—Sub-assistant, U. S. Coast and Geodetic Survey, San Francisco, Cal.

William C. Minger, M. E.—Assayer and Chemist, Pueblo, Colorado.

Cyrus H. Emerson, C. E.—Denison, Texas.

Oscar E. Garvens, M. E.—Lead City, Dakota.

John D. Greason, M. E.—Assistant Engineer and Right-of-Way Agent, D., M. and A. R. R.

1877.

A. H. Ohmann-Dumesnill, M. E.; M. D., St. Louis Medical College, '80.—Since '83, Professor of Dermatology and Syphilography, St. Louis College of Physicians and Surgeons. Vice-President of Ninth International Medical Congress, '87.

James A. Pack, M. E.—Assayer, Butte City, Montana.

*Thomas H. Milsaps, C. E.

1878.

Wilton R. Brown, M. E.—Assayer for Shakespeare Gold and Silver Mining Co., Shakespeare, New Mexico.

Lee R. Grabill, M. E.—Assistant Engineer, U. S. River and Harbor Improvement, Washington, D. C., and Fredericksburg, Va. Superintendent of Battery Station, U. S. Fish Commissioner, Havre De Grace, Maryland, '85-6.

William Y. Bean, C. E.—Engineer Missouri Pacific Railway.

*Lindsay L. Coppedge, C. E.—Engineer Missouri Pacific Railway.

1879.

Charles F. Winters, M. E.—Assayer, New Mexico.

Rudolph C. Hoyer, C. E.—Draughtsman, U. S. Engineer's office, Memphis, Tenn.

1880.

Arthur C. Carson, M. E.—Assayer, Butte City, Montana.

Lorin X. Smith, M. E., C. E.—Mining Engineer, Silver City, New Mexico.

1881.

Edward B. Summers.—Engineer Missouri Pacific Railway, '81. U. S. Topographical Survey, '86. Engineer Kansas City, Wyandotte and Northern Railway.

Walter Wishon.—Denver, Colorado.

1882.

Frank W. Gibb, C. E., M. E.—Mining Engineer, Assayer and Chemist, Little Rock, Ark. Associate American Institute of Mining Engineers.

W. R. Painter, C. E.—County Surveyor, Moberly, Mo.

A. B. Schrantz, C. E.—Engineer Union Pacific Railway.

H. N. Van Devander, C. E.—Engineer St. Louis and San Francisco Railway, '82-3. Engineer Anniston and Atlantic Railway, '83-4. Now Superintendent R. M. & M. Co.'s Iron Mines, Priors, Georgia.

B. Ross, M. E.—Editor, Houston, Mo.

1883.

Floyd Davis, C. E., M. E.; M. Sc., Adrian College, '84; Ph. D., Miami University, '88. Professor of Chemistry and Metallurgy, Virginia Agricultural and Mechanical College, '83-6.—Lecturer on Assaying and Metallurgy, Dakota School of Mines, '87.—Now Professor of Chemistry and Physics, Drake University; Chemist of Iowa State Board of Health; and non-resident Professor of Metallurgy, Wisconsin State University.

1884.

Curtis Alexander, C. E., M. E.—Assistant Division Engineer Leavenworth Northern and Southern Railway, '86-7.—Chemist for U. S. Antimony Company, '87-8.—

Now Assayer and Chemist for Mexican Ore Company, Laredo, Texas.

W. M. Claypool, C. E., M. E.—Chemist, Fairbank, Arizona.

P. C. Gallaher, M. E.—Assayer and Chemist, Leadville, '84-7. Sup't of Minnie Mine, Breckenridge, Colorado, '87-8. Now Assayer and Chemist, Aspen, Colorado.

A. Neustaedter, M. E.—Office of President of Board of Public Improvements, St. Louis, Mo. Now Sup't of St. Genevieve Copper Works, St. Genevieve, Mo.

Frank Wilson, C. E.—Engineer St. Louis and San Francisco Railway.

1885.

*J. R. D. Owen, M. E.—Chemical Laboratory School of Mines.

P. R. Van Frank, M. E.—Assistant Engineer Verdigris Valley, Independence and Western Railway.

F. C. Wilson, C. E.—Resident Engineer Burlington and Northern Railway. Division Engineer Union Pacific Railway. Now Resident Engineer for Atlanta Bridge Co., Atlanta, Georgia.

1886.

J. G. Martinez, M. E.—Assistant Chemist, Coahuilo, Mexico. Now in the employ of the Mexican International Railway.

Jay Cullens, C. E.—Engineer Union Pacific Railway.

James E. Fulcher, C. E.—Draughtsman Missouri Pacific Railway, '86. Draughtsman St. Louis and San Francisco Railway, '87. Now Principal of Akinsville Normal and Commercial Institute, Akinsville, Mo.

1887.

O. Lachmund, M. E.—Chemist for Western Steel Co., St. Louis, Mo., '87. Bullion Sampler for Holden Smelting Co., Denver. Now employed by Grand View Mining and Smelting Co., Rico, Colorado.

M. W. Yeater, M. E.—Chemist for Western Steel Co., St. Louis, '87. Assayer for Gold King Mine, Telluride, Colorado. Now City Engineer, Sedalia, Mo.

G. W. Cole, C. E.—U. S. Coast Survey. Now Engineer Missouri Pacific Railway.

George B. Wiles, C. E.—Engineer Missouri Pacific Railway. Now employed by St. Louis Bridge and Iron Company, St. Louis, Mo.

Mary Kyle, Academic.—Teacher, Troy, Ohio.

1888.

Elizabeth Harrison, Academic.—At home, Rolla, Mo.

Minerva G. Seay, Academic.—Teacher, West Plains, Mo.

*Deceased.

CATALOGUE OF STUDENTS.

Alexander, Thompson,	-	Technical,	-	Fort Smith, Ark.
Bland, Richard,	- - -	Academic,	-	Phelps County.
Bland, Thomas,	- - -	Academic,	-	Phelps County.
Bowles, Frank C.,	- - -	Technical,	-	Phelps County.
Brucher, Bertha,	- - -	Academic,	-	Phelps County.
Bullock, J. R.,	- - -	Technical,	-	Phelps County.
Buskett, L. W.,	- - -	Technical,	-	Phelps County.
Buskett, Evans W.,	- - -	Academic,	-	Phelps County.
Buskett, Nancy H.,	- - -	Academic,	-	Phelps County.
Buskett, Mary P.,	- - -	Academic,	-	Phelps County.
Campbell, Joseph G.,	- - -	Technical,	-	Phelps County.
Coffey, Margaret J.,	- - -	Academic,	-	Phelps County.
Coffman, Walter S.,	- - -	Technical,	-	Phelps County.
Cole, H. M.,	- - -	Technical,	-	St. Louis.
Corey, Stephen J.,	- - -	Technical,	-	Phelps County.
Crandall, Arthur L.,	- - -	Technical,	-	Pettis County.
Dean, George R.,	- - -	Technical,	-	Waterloo, Ill.
Deegan, Agnes J.,	- - -	Academic,	-	Phelps County.
Donahoe, Mary A.,	- - -	Academic,	-	Phelps County.
Fairclough, Jeannette,	- - -	Academic,	-	Crawford County.
Faulkner, Millard F.,	- - -	Technical,	-	Phelps County.
French, Kate A.,	- - -	Academic,	-	Phelps County.
Greaber, William,	- - -	Technical,	-	Phelps County.
Greensweight, A. H.,	- - -	Technical,	-	Phelps County.
Harrison, Daisy,	- - -	Academic,	-	Phelps County.
Heller, Jessie E.,	- - -	Academic,	-	Phelps County.

Herdman, George W.,	- Technical,	- Neosho Falls, Kan.
Hill, Nora A.,	- - - Academic,	- Pulaski County.
Holman, William P.,	- Technical,	- Dent County.
Housewright, Lorenzo D.	Technical,	- Crawford County.
Hume, Dorothea,	- - Academic,	- Phelps County.
Hutcheson, Charles G.,	- Academic,	- Halstead, Kan.
Illinski, Anielka,	- - Academic,	- Cahokia, Ill.
Johnson, Edward M.,	- Technical,	- Phelps County.
Jordan, Stuart J.,	- - Technical,	- Phelps County.
Karr, Rosa L.,	- - - Academic,	- Phelps County,
Long, E.,	- - - - Technical,	- Phelps County.
Millard, Fannie C.,	- - Academic,	- Phelps County.
Millard, Mary E.,	- - Academic,	- Phelps County.
Millard, Sarah E.,	- - Academic,	- Phelps County.
Morgan, Minerva E.,	- Academic,	- Phelps County.
Murphy, Kate C.,	- - Academic,	- Phelps County.
Murphy, Mary E.,	- - Academic,	- Phelps County.
Nievert, Waldemar,	- Academic,	- Germany.
Parker, Luman F.,	- - Academic,	- Phelps County.
Perry, John E.,	- - - Technical,	- Phelps County.
Porter, James M.,	- - Technical,	- Phelps County.
Puckett, Letitia M.,	- - Academic,	- Crawford County.
Puckett, Prentice C.,	- Technical,	- Crawford County.
Richards, Thomas H.,	- Technical,	- Riverton, Va.
Saltsman, Thomas M.,	- Technical,	- Crawford County.
Schwietzer, George J.,	- Technical,	- St. Louis.
Seamon, Frank H.,	- - Technical,	- Wheeling, W. Va.
Seay, Virginia M.,	- - Academic,	- Dent County.
Seay, William J.,	- - Technical,	- Dent County.
Smith, William H.,	- - Technical,	- Phelps County.
Southgate, Margaret,	- Academic,	- Phelps County.
Staats, L. H.,	- - - Technical,	- St. Louis.
Vaughan, Robert E. L.,	Technical,	- Dent County.
Walker, James C.,	- - Technical,	- Phelps County.
Walker, William T.,	- Technical,	- Phelps County.

Wasson, Alonzo, Jr., - Technical, - Gainesville, Texas.
Weber, Elizabeth B., - Academic, - Phelps County.
Wood, Minerva M., - - Academic, - Phelps County.
York, Elizabeth L., - - Academic, - Phelps County.

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